

Talking Notes for Jerald A. Cole, Independent Consultant to the City of Yorba Linda, California

## Public Hearings Regarding the Anaheim Canyon Power Project

California Energy Commission

City of Anaheim

Southern California Public Power Authority

South Coast Air Quality Management District

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### *Opening Statement*

The peak shaving, or peaking power plant proposed as the *Canyon Power Project*, is conceived as a group of four GE LM6000 Sprint PC simple cycle gas turbines equipped with state of the art emissions control systems that will set a new BACT level of 2.3 ppm NO<sub>x</sub> for simple cycle turbine power plants in the South Coast Basin.

As laudable as this sounds, it does not tell the whole picture, and in fact ignores alternative power plant configurations that can achieve the same targets of availability, reliability and power production while reducing *total* emissions of priority pollutants, including oxides of nitrogen, carbon monoxide and particulate matter, while also supporting the spirit of California Assembly Bill 32 by reducing the amount of greenhouse gas emissions associated with the electrical power generated by the Canyon Power Project.

In a recent white paper released by the City of Anaheim on April 16, 2009, and entered into California Energy Commission Docket 07-AFC-9, it is concluded that the plant configuration as proposed is the **“optimum” alternative for meeting the goals and obligations of the plant. There are two points that bear examination in this regard.** The first is the somewhat intricate and detailed set of guidelines that define the business case for building and operating the Canyon Power Plant. The second is the meaning of **“optimum”**.

In describing the operation of the Canyon Power Plant and the business case for its construction it would appear that the business case itself was developed to justify a low cost simple cycle power plant, rather than conclude that simple cycle is the best way to meet the business case.

**Regarding the “optimum” alternative argument as proposed in the Anaheim white paper, it should be noted that the word “optimum” is followed parenthetically by the phrase “least cost”.** This bears further consideration.

In my following comments I will show that existing, proven gas turbine technology is available today that is capable of meeting all the functional requirements of the Canyon Power Project while reducing pollution and greenhouse gas emissions by 20 percent or more on a levelized basis.

## Introduction

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Simple cycle peaking power plants became immensely popular in the first years of this waning decade as power outages – blamed on electricity market deregulation – required a fast, inexpensive and simple solution. The GE LM6000 gas turbine, a highly reliable byproduct of jet aircraft development, became the *de facto* currency in trade for this purpose. Capable of reaching full power in ten minutes or less, and shutting down in less than half that time it is really an amazing piece of engineering. Over 40 peaking power plants are now operating in California, and most of them use one or more of this 43 MW turbine generator package.

The combined cycle gas turbine power plant is considered the gold standard in terms of fuel efficiency and low emissions of pollutants. The newest plants are boasting efficiencies in excess of 60 percent, **nearly twice that of the proposed Canyon Power Project. However, what is called “conventional”** combined cycle is not consistent with peaking operation. A combined cycle turbine power plant combines the best features of both gas turbines and old-style steam boilers. The gas turbine generates electric power, but then the hot turbine exhaust is sent to a boiler to produce high-pressure steam that drives a steam turbine to produce even more electric power.

**The trouble with these “conventional” combined cycle power plants is that the boiler, while robust,** reliable and efficient, simply takes a long time to start up. Not only that, but the turbine itself needs to be started up carefully so as not to damage the boiler by exposing it to hot gases too quickly.

Thus, one of the big advantages of simple cycle peaking power plants is that they allow their larger brethren – baseload combined cycle power plants – to operate at high efficiency with low pollutant emissions, while the less efficient, and slightly more polluting peakers deal with sudden changes in demand for electricity. Peakers can also be more readily located close to where power is needed so transmission losses are reduced.

However, while simple cycle peakers seemed to make a lot of sense nearly ten years ago, technology was and has continued to advance. There is an alternative combined cycle technology that can meet the needs of the Canyon Power Project while meeting all the requirement for rapid start and shut down, reliability, availability and power generation. This technology, called once-through-steam-generation, or OTSG has been around for over 80 years, but it was less than 30 years ago that it became possible to consider it for peaking power plant applications.

The main feature of OTSG for peaking power plants is that **unlike “conventional” combined cycle power plants, the OTSG boiler can be “run dry”.** This allows the gas turbine itself to operate as a peaker without regard to the operation of the boiler. The first U.S. installation of this technology appears to have been in York, Pennsylvania in 1989. That plant was not designed for combined cycle operation. Rather the steam generated in the OTSG boilers was used for cogeneration. Neither was it envisioned that the boilers would need to start quickly.

In the interim, however, the steam boiler and steam turbine startup times have been diminishing. In 1998 Siemens installed OTSG peaking technology in the Cottam Development Centre in the U.K. The gas turbines in that plant could start in ten minutes, and the steam turbine could be brought to full power in

about 45 minutes or less. Since that time, the start up time for the steam turbines has continued to get faster, with times as short as 40 minutes by 2005 and as short as 20 minutes since 2007, depending on how the overall power plant is designed and operated.

During the mid 1990s through the early part of this decade several OTSG power plants came on line in Canada. Some of these were designed for base load combined cycle operation, but some, like the Encana Power Project in Alberta soon adapted to combined cycle *peaking* operation, with the option of simple cycle operation if the peak demand period is short. This trend toward OTSG combined cycle power plants with peaking capability has continued in both the U.S. and Canada and has been accelerating for the past eight years.

In fact, in preparing background for this discussion over 44 rapid start, or peaking OTSG power plants were identified worldwide, with all but three already in operation. Most of these are either capable of, or are routinely operated as peakers. More of these plants use the GE LM6000 than any other model of gas turbine. Ten of the currently operating plants are located in the U.S., with many more in Canada and Europe. The three plants not yet operational are in fact pending before the *California Energy Commission* and planned for installation in San Joaquin Valley and in El Segundo.

### Combined Cycle and Canyon Power

The Canyon Power Project was originally conceived and proposed as a 4,000 hour per year power plant that would reduce electricity costs for Anaheim ratepayers and provide a total net benefit to the city of \$17 million annually – after debt service. As a result of a court ruling last summer, the availability of emissions offset credits was severely curtailed, requiring the project developers to devise a new strategy that would enable the plant to be built, while still providing an economic incentive to do so.

This strategy included two key features. First, the plant is to be permitted for significantly fewer hours of operation – about 2,400 instead of 4,000. Secondly, the total number of times the plant will be allowed to start and stop each year has been *increased* from 129 to 240 starts per turbine. This means that while total annual emissions from the power plant will be reduced, the amount of pollution released during each start/stop cycle may be increased, depending on the frequency and typical duration of each start/stop cycle.

This increase in the number of starts per turbine is a smoking gun. In their April 16 white paper justifying a simple cycle configuration, Anaheim argues that the financial paradigm for the Canyon Power Project does not match that of a combined cycle power plant, where cost of energy is a factor. However, this increase in the number of allowed starts per turbine will allow Canyon Power to operate more flexibly within the CAISO system, providing peaking power for short periods when the spot market price for power is high, turning the plant from a public service utility into a profit center.

The proposed configuration of the power plant is a technically conservative and fiscally responsible design. Simple cycle LM6000 turbines generators, used singly or in combination, were introduced in 1990, and as of last year there were over 735 units in service. Installation and operation of the LM6000

therefore presents a minimum of technical risk and provides a significant amount of prior experience to build upon.

However, we are operating under different rules and priorities than we were in the year 2001. Air quality remains an issue, and while power plants contribute only about 3 percent to the air pollution burden in the South Coast Basin, they are still among the lowest cost places to achieve reductions in pollution emissions. In addition, we are now, and have been for some time, under the rubric of reducing **greenhouse gas emissions. We've known about AB32 and its implications since 2006** – in fact, the signing of this law occurred 15 months before SCAPPA filed their application for certification of the Canyon Power Project.

**The desire for Anaheim to pursue the safe and low cost route to meeting the region's power needs is understandable. However, it is inconsistent with California's desire and intention to remain a forward thinking leader in environmentally sound energy policy.**

### *Concluding Statements*

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If the Canyon Power Project is reconfigured as a combined cycle power plant, under the operating scenario described in the modified permit application, turbine start up, time to power and emissions will be unaffected by OTSG in normal cold start operation. During normal operation, emissions will be reduced for a given level of power output.

Use of OTSG combined cycle technology in lieu of simple cycle turbines will result in a small, but real reduction in on site water consumption as a result of eliminating one combustion turbine and associated steam injection. Furthermore, the absence of a steam drum and blow-down tank in the OTSG configuration will reduce the demands for water quality and corrosion inhibitors in the boiler feedwater.

Personnel and maintenance requirements for OTSG- based combined cycle operation are manageable and not likely to be as great as projected by Anaheim.

All indications are that steam turbine start up times will be significantly shorter than claimed by Anaheim. Providers of OTSG hardware and plant control systems are and have been guaranteeing short start up times for the steam cycle that are consistent with planned and envisioned operation of Canyon Power. In addition, hot standby can allow for earlier start up of the SCR emissions control system and earlier light off of the CO oxidation catalyst. This would result in reduced startup emissions that could in turn provide justification for increasing hours of operation, as long as net annual emissions do not increase.

The year 2012 turbine operations profiles used as example by Anaheim are completely compatible with combined cycle operation with OTSG technology. On certain days during this profile turbines are running up to 15 hours per day. But even the shortest runs projected, at three hours, would benefit from combined cycle operation, especially if the steam path were maintained in hot standby. It also needs to be emphasized that the year 2012 scenario is not typical of plant operation over its lifetime. In planning for future energy needs Anaheim should be thinking ahead and applying the most advanced and energy

efficient technology currently proven and available – and not relying on ten year old approaches to handling peak power needs.

Installed costs will be higher, as suggested by Anaheim. However in later years this should result in reduced fuel consumption and, as other plant operators have found or are projecting. This translates into a reduced levelized cost of electricity over the life of the plant. **Thus, the phrase “lowest cost” is irrelevant and does not qualify as the “optimum” configuration.**

It is all but certain that the operating permit for Anaheim will be changed over time to permit increased operating hours. It can also be expected that likely future circumstances, including natural disaster (fires, earthquakes, grid failure, other) will result in executive orders temporarily suspending restrictions on hours of operation. All of this points to a need to install a more efficient and cleaner power plant now.

It is recognized that a more efficient power plant will find a more favorable position on CAISO loading order. However, this still means displacing less efficient and more polluting plants in the basin, effectively reducing emissions regardless (as being more efficient will not result in greater electricity demand).

As more renewable energy resources come on line, Canyon will be needed to provide load leveling as well as peaking support to the local grid. Ramping of the simple cycle turbines results in emissions increases that can be at least partially mitigated by ramping the steam turbine as well.

**While the City of Anaheim make many good points in their “justification” document, the evidence that I have presented here supports a countervailing conclusion that in looking forward, the installation of combined cycle capability in the Canyon Power Plant *today* will provide the best *overall* solution to *current and future* needs for electrical power in Anaheim and across the South Coast Basin.**

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